

ARSENIC in FOOD & WATER

Model 33W- Arsenic in water
Model 33F Arsenic in food



Model 33 Compact, Inexpensive & Easy to Use



Hydride Generation (HG)/PID for Water, HG/GC/PID for samples with organic content like Juices, Rice, foods... ppb to ppt levels

PID
ANALYZERS

ARSENIC ANALYZERS

Low Cost Arsenic Analyzers

Model 33

Introduction

Consumer Reports (January 2012) tested 5 brands of juices and found that 10% had total arsenic levels that exceeded federal drinking-water standards of 10 ppb. Dr. Brian Jackson & co-workers at Dartmouth College tested products sweetened with organic brown rice syrup, including cereal bars and baby formulas, and found ppb levels of arsenic that exceeded standards for bottled water.

FDA Method

The FDA tests for total As. If the total As is > 23 ppb, a test for inorganic As is run. The standard is based on the concentrations of As(III) + As(V). The inorganic As compounds are more toxic than the organic forms monomethyl and dimethyl arsenic. The FDA standard for As in juices may be lowered in the near future..

What are Hydrides?

A hydride is a compound in which one or more hydrogen atoms have reducing, or basic properties. In hydrides, hydrogen is bonded to a more electropositive element such as a metal. When arsenic compounds in solution are treated with a reducing agent (NaBH_4), a hydride, is formed (AsH_3), and this is one of the most common pretreatment methods for determining aqueous arsenic.

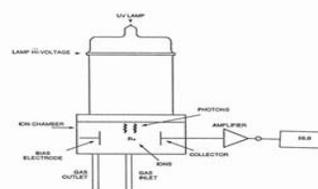
Detection of Arsenic

More than 25 years ago, Cutter et al (1988) developed a method for detecting ppb levels arsenic in seawater us-

ing hydride generation/GC/Photoionization (PID). We have modified that PID method for As in drinking water and foods.

PID

The PID uses a 10.6 eV lamp (the Ionization Potential for AsH_3 is 10.6 eV) to ionize arsine (g) generated by reduction with NaBH_4 . When AsH_3 absorbs a photon, it forms a positive ion AsH_3^+ plus an electron (e^-). The positive ions are collected in an ionization chamber where the bias electrode pushes the ions to the collection electrode and the current collected is proportional to the concentration over a range of 10^7 from ppb to high ppm. A schematic of the PID is shown below.



The PID has been employed by the US EPA to develop more than a dozen standard methods for the measurement of ppb levels of VOC's in drinking water.

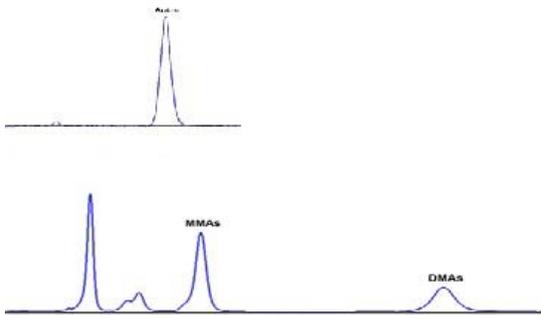
If there are high ppb levels of organics in the water then the HG/GC/PID method should be used to separate the AsH_3 after the preconcentration phase to prevent any interference.

The organic level can be determined by simply running a blank *without adding* any NaBH_4 to the sample.

Arsenic Types, Speciation & Software

As Types-

Inorganic Arsenic exists in nature in two forms As(III) and As (V) with the former being more toxic. Organic arsenic compounds such as monomethyl arsenic (MMA) and dimethyl arsenic (DMA) are less toxic than the inorganic form and have been used as a herbicide. As (III) & As(V) can be separated using the pH of the hydride generating solution (see below) and the resulting AsH_3 detected by GC/PID shown below at a low ppb level (Courtesy Greg Cutter, Old Dominion Univ.)



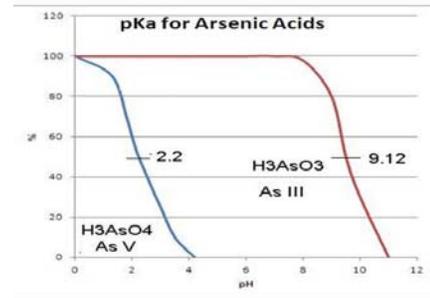
The MMA and DMA are easily separated by GC and detected by the PID.

Arsenobetane, an organoarsenic compound that is found in fish that is supposedly non toxic.

Speciation

The inorganic arsenic compounds can be easily separated by pH as shown in the figure in the next column.

If the pH is in the 4-8 region (Tris buffer), the H_3AsO_3 is the predominant species while any As (V) exists as the anion and will not be converted to AsH_3 by HG. **By modifying the pre treatment both Cd and Pb can be detected with this analyzer.**



Now if the pH is increased to <1, and HG occurs, the measurement will be total inorganic arsenic (As (III) & As(V).

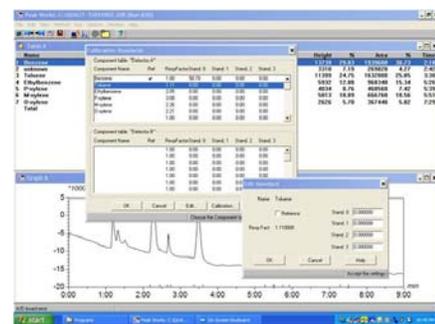
The MMA and DMA can be determined with the As (III), separated by a GC column and detected by a PID.

Hydride Generation

Hydride generation is a common pretreatment method for the measurement of aqueous As. For the PID method, it is different than the AA method. NaBH_4 is added to a pH adjusted solution of As and the As is converted to AsH_3 gas which is sparged from the solution and collected on a solid sorbent.

Software

The analyzer is controlled by our Peak Works software that runs on Windows operating system on the embedded PC.



Specifications for Two Types of R & D 100 Award Winning Arsenic Analyzers

Model 33W- Arsenic in Water (no organics) Tap water, well water or bottled water that does not contain volatile organic compounds does not need a GC for removal of VOC's from the AsH_3 peak so a GC is not needed and this version is less expensive.

Principle of Operation

HG/GC/PID

Specifications-

Hydride Generator
Peltier cooler for moisture removal
Concentrator/thermal desorber
Computer:
Pentium PC
Operating System: Windows
Color Touch Screen Display 8"
Keyboard/Mouse
PeakWorks-Chromatography/control software
8 Gbyte memory stick
16 bit ADC/ 4 ranges
Autozero
5 timed events
PID with 10.6 eV lamp
NEMA 2 Enclosure- General purpose
19" W x 9"H x 16"D;
Weight- 18 pounds
Standard output: 0-1 VDC, RS232;
internet connection



Model 33F- Arsenic in Foods

Most juices and foods contain many organic compounds. Apple juice, for example, has more than 300 organic compounds including alcohols, esters, etc. A GC is necessary to prevent any interference from organics

Principle of Operation

HG/GC/PID

Specifications-

Hydride Generator
Peltier cooler for moisture removal
Concentrator/thermal desorber
Computer:
Pentium PC
Operating System: Windows
Color Touch Screen Display 8"
Keyboard/Mouse
PeakWorks-Chromatography/control software
8 Gbyte memory stick
Gas chromatograph
PID with 10.6 eV lamp
Oven:
Packed or capillary
Isothermal or Temperature programmed
16 bit ADC/ 4 ranges
Autozero
5 timed events
NEMA 2 Enclosure- General purpose
19" W x 9"H x 16"D;
Weight- 18 pounds
Standard output: 0-1 VDC, RS232;
internet connection

PID 
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